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WATER MANAGEMENT

ACTIVITIES

EAST POPLAR RIVER BASIN

1982

Report No. HYD-2-10

Prepared by:

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SYNOPSIS

This report summarizes the activities of the Water Management Service (WMS) in the East Poplar River Basin in 1982. This format replaces a series of bi-monthly reports prepared by the various WMS Divisions which was initiated in 1978.

The Ground Water Division monitored water quality aspects of the ground water monitoring program in the basin and provided advice to other department branches on request. The Surface Water Division moved closer to licensing Cookson Reservoir under The Water Rights Act and identified non-contributing drainage areas in the basin.

The Hydrology Branch forecast spring runoff flows in the East Poplar River Basin in 1982. The runoff was above normal and resulted in the reservoir filling and a peak flow at the International Boundary of 83 m^3/s.

During several days in January, February, March and August the flows at the International Boundary were slightly below the minimum flow requirements as per the interim apportionment formula. Procedures have been set up to ensure that this problem will not recur.

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CHAPTER I

INTRODUCTION

The East Poplar River basin is situated in southern Saskatchewan about 150 km south of Moose Jaw. The East Poplar River has its headwaters in Saskatchewan and flows south into the State of Montana where it joins the Middle and West forks of the Poplar River. The drainage area in Canada is 1400 km^2. A plan showing the East Poplar River Basin in Saskatchewan is shown on Figure 1.

In the 1970s Saskatchewan Power Corporation (SPC) began work on a thermal electric generating station, a lignite mine and a cooling water reservoir in the East Poplar River Basin near Coronach, Saskatchewan. One 300 megawatt thermal generating unit was brought on line in 1980, with the second 300 megawatt unit scheduled for completion in 1983.

The Water Management Service of Saskatchewan Environment has been monitoring various aspects of these developments. The dewatering programs for the coal beds and monitoring of ground water levels and quality in the coal bed area, ash lagoon area and near Cookson Reservoir are of prime interest for the Ground Water Division of the Water Rights Branch. The Surface Water Division of the Water Rights Branch licences surface water development projects such as Cookson Reservoir. The Operations Division of the Hydrology Branch provides a water supply forecasting service for Cookson Reservoir,

advises SPC on reservoir operations and ensures release are made to meet apportionment commitments to the State of Montana.

The Environmental Protection Service of Saskatchewan Environment monitors water and air quality in the area and participated in the development of air and water quality standards as specified by the Poplar River Bilateral Monitoring Committee of the International Joint Commission (IJC).

CHAPTER II

WATER RIGHTS BRANCH ACTIVITIES

A. GROUND WATER

The Ground Water Division provided technical advice on an ongoing basis to the provincial representative on The Poplar River Bilateral Monitoring Committee in 1982 on water quality and quantity aspects of the ground water monitoring program in The East Poplar River Basin. Technical advice was also given to The Enviromental Protection Service concerning SPC's dewatering wells.

B. SURFACE WATER

The major project in the East Poplar River basin from a surface water point of view is Cookson Reservoir. The licencing process for this project began in 1972. In 1980 a request was sent to SPC for information on land control for temporary surcharging, topographical information and copies of agreements with the Rural Municipality involved, Saskatchewan Highways and the CPR. SPC provided all required information with the exception of agreements with CPR and Saskatchewan Highways, which are awaiting clearance through CPR's legal department.

During 1982, SPC was again contacted regarding the outstanding requirements for their Cookson Reservoir. SPC replied that they were in the process of finalizing agreements with the CPR and Saskatchewan Highways.

In June, the Order-in-Council reserving all unappropriated water except for municipal and domestic uses in the Poplar River's basin expired.

In September, SPC submitted an application form for the diversion of water from Middle to the East Poplar River to supply two additional 300 mw units at the Poplar River plant from the East Poplar River.

In view of this, the restriction on new development within the East Poplar and Middle Poplar Basins was continued.

However, a backflood irrigation project in the East Poplar River will be authorized and licensed in the near future once the land control requirements are fulfilled. This project does not result in a net usage of water since the consumptive use will be less than evaporative losses would have been prior to the project's development. As far as the West Poplar Basin is concerned, applications for further development will be accepted.

CHAPTER III

HYDROLOGY BRANCH ACTIVITIES

A. GENERAL

Cookson Reservoir is owned and operated by SPC. The Hydrology Branch provides a forecasting and operation planning service to SPC and advises SPC on reservoir operations. The Hydrology Branch also administers the interim apportionment arrangement with the U.S. to ensure that base flows and demand releases are achieved.

B. WATER SUPPLY FORECASTING

Water supply forecasts are prepared each year prior to the spring runoff to aid in the operation planning for Cookson Reservoir. These forecasts are based on three precipitation periods recorded at Coronach: the previous August to October (Antecedent), November to February (Winter) and March. The recorded precipitation in the basin from August 1981 to December 1982 is shown in Table 1. Recorded precipitation during the fall and winter of 1981-1982 was 130 per cent of normal.

Snow surveys are conducted each year and the results of the 1982 measurements are shown in Table 2. The locations of the snow courses are shown on Figure 1. The 1982 snow pack was much above normal.

Table 1

PRECIPITATION IN THE EAST POPLAR RIVER BASIN
1981 - 1982

	Coronach	West Poplar*	
	Recorded (mm)	Recorded (mm)	Normal (mm)
August 1981	51.0	19.4	32.3
September 1981	8.0	19.6	27.7
October 1981	37.0	21.4	13.4
November 1981	27.0	14.6	11.2
December 1981	25.5	13.2	12.2
January 1982	41.0	75.5	18.5
February 1982	34.0	17.4	11.5
March 1982	33.0	17.4	9.7
April 1982	25.0	10.2	22.7
May 1982	166.5	175.4	48.8
June 1982	41.0	27.4	65.7
July 1982	80.0	38.2	46.5
August 1982	20.0	17.8	32.3
September 1982	30.0	37.0	27.7
October 1982	22.0	17.6	13.4
November 1982	5.0	1.2	11.2
December 1982	24.5	13.2	12.2
1982 Totals	522.0	448.3	320.2

*For comparison purposes.

Table 2

1982 SNOW SURVEY RESULTS
EAST POPLAR RIVER BASIN

	February 15		March 15	
	Snow Depth (cm)	Water Equiv. (mm)	Snow Depth (cm)	Water Equiv. (mm)
Coronach N.	23.7	62.7	28.0	98.3
Coronach S.	23.8	66.5	25.9	78.7
Fife Lake	31.1	91.9	35.6	166.6
Willow Bunch	18.4	43.2	13.1	47.5

The snow survey results were considered, along with the results of regression equations based on precipitation, in preparing water supply forecasts for 1982.

Table 3 provides a comparison of the forecast inflow volume and peak mean daily inflow for Cookson Reservoir on the various forecast dates in 1982 and that actually recorded.

Table 3

COOKSON RESERVOIR INFLOW FORECASTS

Forecast						Recorded	
March 1		March 15		April 1			
Volume*	Peak**	Volume	Peak	Volume	Peak	Volume	Peak
18×10^6	30	25×10^6	50	25×10^6	50	34×10^6	83

* Volume for the March-May period in m^3.
** Peak mean daily flow in m^3/s.

C. 1982 STREAMFLOW AND WATER SUPPLY

Cookson Reservoir was at elevation 751.87 m on January 1, 1982 (FSL is 753.0 m) and had risen to 751.97 m by March 24 with inflow from Girard Creek. A release of 1 m^3/s was started from the riparian pipe on March 24 and increased to full pipe

capacity (4.0 m^3/s) on April 8. This caused the reservoir to recede to 751.65 m on April 11, the lowest elevation recorded in 1982.

Spring runoff commenced in the Girard Creek basin on April 11 and in the East Poplar River basin on April 13. Cookson Reservoir began rising rapidly and by April 14 was at 752.54 m. On the same day, Girard Creek near Coronach peaked at 42.4 m^3/s and East Poplar River above Cookson Reservoir peaked at 30.0 m^3/s. One spillway gate was opened completely at 14:00 hours on April 14. The second spillway gate was completely opened at 2:00 hours on April 15 as the reservoir continued to rise to a peak elevation of 753.03 m. The flow in the East Poplar River at the International Boundary increased from 4.3 m^3/s on April 13 to 18.2 m^3/s on April 14 when one gate was opened, and to a peak flow of 83.0 m^3/s on April 15 when both gates were fully opened.

Inflow to the reservoir receded quickly and by April 20 flows at both Girard Creek near Coronach and East Poplar River above Cookson Reservoir were less than 2 m^3/s. With the peak flows past, Cookson Reservoir level was manipulated and maintained by operating the spillway gates and riparian outlet pipe. The maximum elevation on the reservoir was recorded on June 2 at 753.16 m. The reservoir then receded to 752.61 m on October 1 before rising to 752.68 m by December 31. This late fall rise

in elevation may be attributed to a reduction in evaporation loss from the reservoir, while, at the same time, there was a constant base flow in Girard Creek from mine pumping. Figures 2 and 3 show the East Poplar River, Girard Creek and Cookson Reservoir hydrographs for 1982.

The annual runoff volumes at the East Poplar River above Cookson Reservoir, Girard Creek near Coronach and East Poplar River at International boundary hydrometric stations are shown in Table 4.

Table 4

1982 SUMMARY OF STREAMFLOW VOLUMES

Station	Annual Volume (dam^3)
East Poplar River above Cookson Reservoir	11100
Girard Creek near Coronach	14340*
East Poplar River at International Boundary	29000

*Incomplete record available.

The change in storage on Cookson Reservoir from January 1, to December 31, 1982, was 5 736 dam^3, a net gain for the year.

D. 1982 COOKSON RESERVOIR OPERATIONS

Operations were made at Morrison Dam in 1982 to control the reservoir level during runoff. No other operations were made during the year. Details of the operations performed are summarized in Table 5.

Table 5

1982 COOKSON RESERVOIR OPERATIONS

Period of Operation	Operation	Purpose
January 1 to March 24	All gates closed.	Flow at International Boundary met by ground water and leakage.
March 24 to April 8	Riparian outlet opened to release 1 m^3/s.	To begin to drawdown the reservoir in preparation for the runoff.
April 8 to April 28	Riparian outlet opened completely.	To pass the runoff inflows.
April 14 to April 16	Spillway gate A opened completely.	To pass runoff flows.
April 15 to April 16	Spillway gate B completely opened.	To pass runoff flows.
April 16 to April 18	Spillway gate B closed.	To regulate reservoir level.
April 16 to April 17	Spillway gate A closed to 1.0 m.	To regulate reservoir level.
April 17 to December 31	Spillway gate A closed.	To regulate reservoir level.
April 18 to April 20	Spillway gate B opened 0.6 m.	To regulate reservoir level.
April 20 to December 31	Spillway gate B closed.	To regulate reservoir level.
April 28 to December 31	Riparian outlet closed.	Leakage and ground water discharges make up flow at International Boundary

CHAPTER IV

APPORTIONMENT

The Poplar River Task Force[1]/ in its 1976 Joint Studies Report for Flow Apportionment for the Poplar River Basin in Saskatchewan and Montana proposed the apportionment formula described in Appendix I. It called for, among other things, equal sharing of the waters of the Poplar River basin, subject to certain allowable variations on specified streams, and to specific delivery schedules.

The Task Force also recommended that the IJC appoint a Poplar River Board of Control, with members selected from the public service of the Governments of Canada, the United States, Montana and Saskatchewan to administer the apportionment under the IJC's direction.

The Poplar River Board of Control has not been formed, however the interim apportionment proposals have been adopted pending the final resolution of the apportionment question.

The recommended international commitment for the January 1 to May 31, 1982 period, based on 1981 runoff, was a continuous flow of

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1/ The Poplar River Task Force was formed by the Souris-Red Rivers Engineering Board following a request by the International Joint Commission for a proposal for flow apportionment in the Poplar River basin.

0.028 m^3/s to be passed at the East Poplar River at the International Boundary.

The 1982 to 1983 international commitment was calculated on the basis of March to May 1982 flow on the Middle Fork of the Poplar River. Data provided by USGS through Water Survey of Canada (WSC) indicated that the natural flow was 29 500 dam^3. The interim apportionment formula states that the commitment to Montana on the East Poplar River with this volume of flow on the Middle Fork is:

1. June 1, 1982 to August 31, 1982 - 0.085 m^3/sec
2. September 1, 1982 to May 31, 1983 - 0.057 m^3/sec
3. Demand release at any time from June 1, 1982 to May 31, 1983 of 1 230 dam^3.

For 16 days in January, 20 days in February and 10 days in March the minimum flow recommended was not achieved. The maximum short fall on a daily basis was 0.005 m^3/s with a total volume short fall for these three months of 13.6 dam^3. Noteworthy, however, is the difficulty of measuring flows to this accuratly under extreme ice conditions such as occur on the reach below Cookson Reservoir. In August the recommended minimum flow was not achieved on 24 days with a maximum daily shortfall of 0.009 m^3/s and a total volume shortfall for the month of 12.7 dam^3. For the remainder of the year the recommended apportionment flows were equalled or exceeded.

The problem of not meeting the recommended minimum flows has been studied and procedures have been set up which should prevent the recurrence of this problem.

FIGURES

Saskatchewan Environment

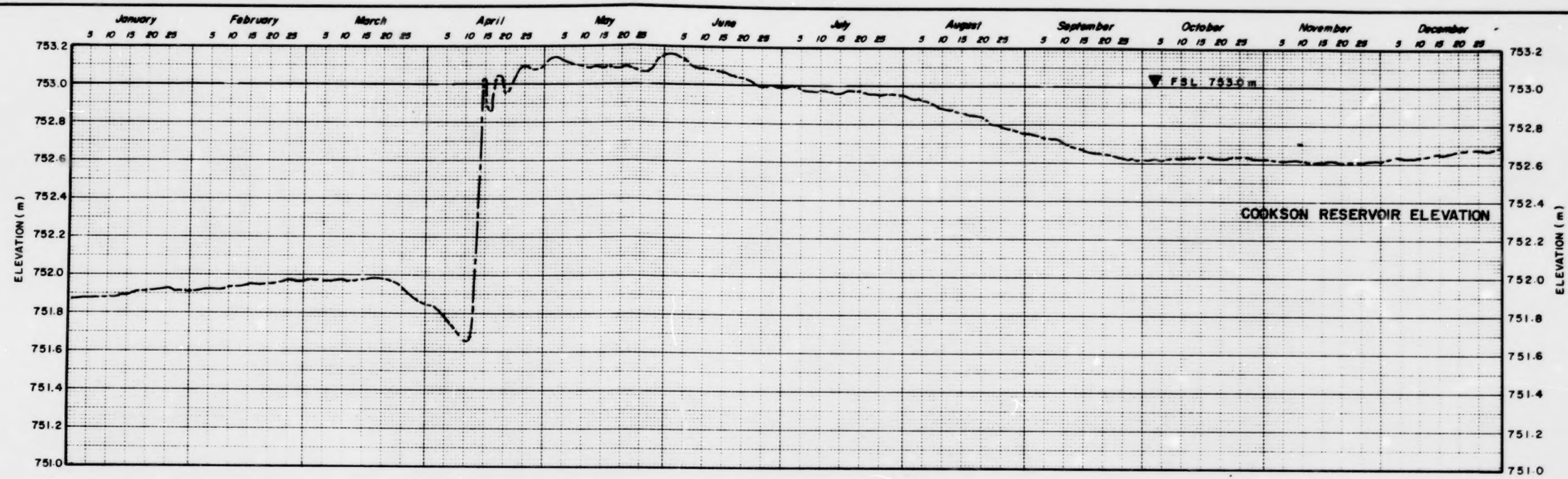
Hydrology Branch

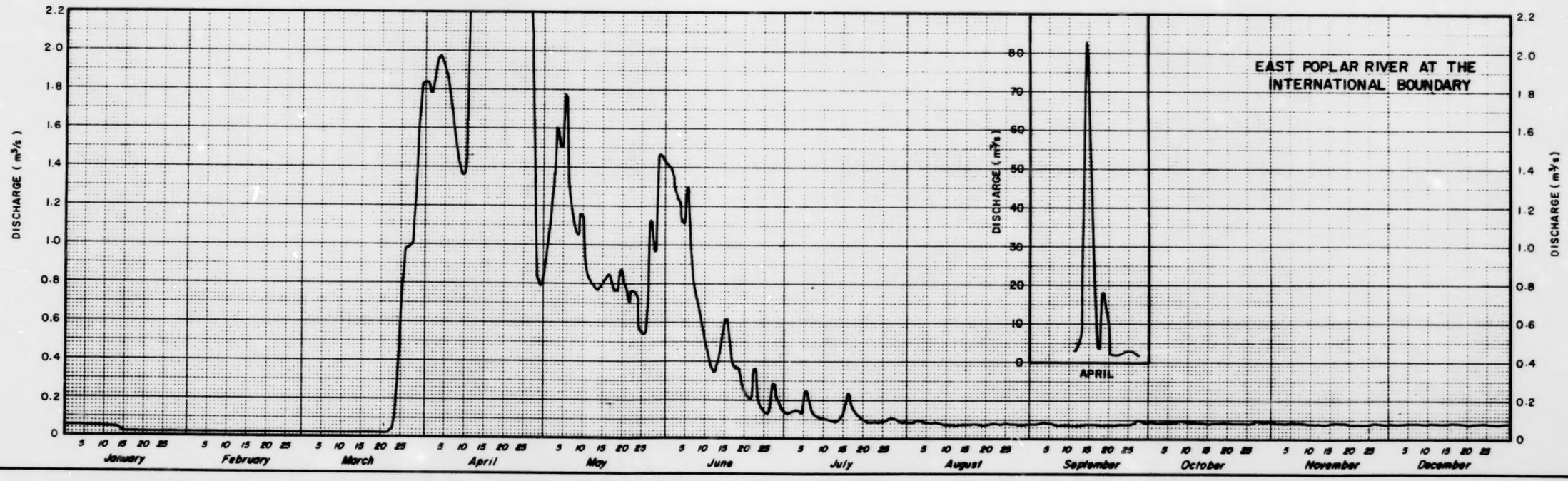
Drn	Date
Ch'd	Plan No. H2-5(35)

WATER MANAGEMENT ACTIVITIES
EAST POPLAR RIVER BASIN
1982

EAST POPLAR RIVER BASIN
KEY MAP

Figure 1





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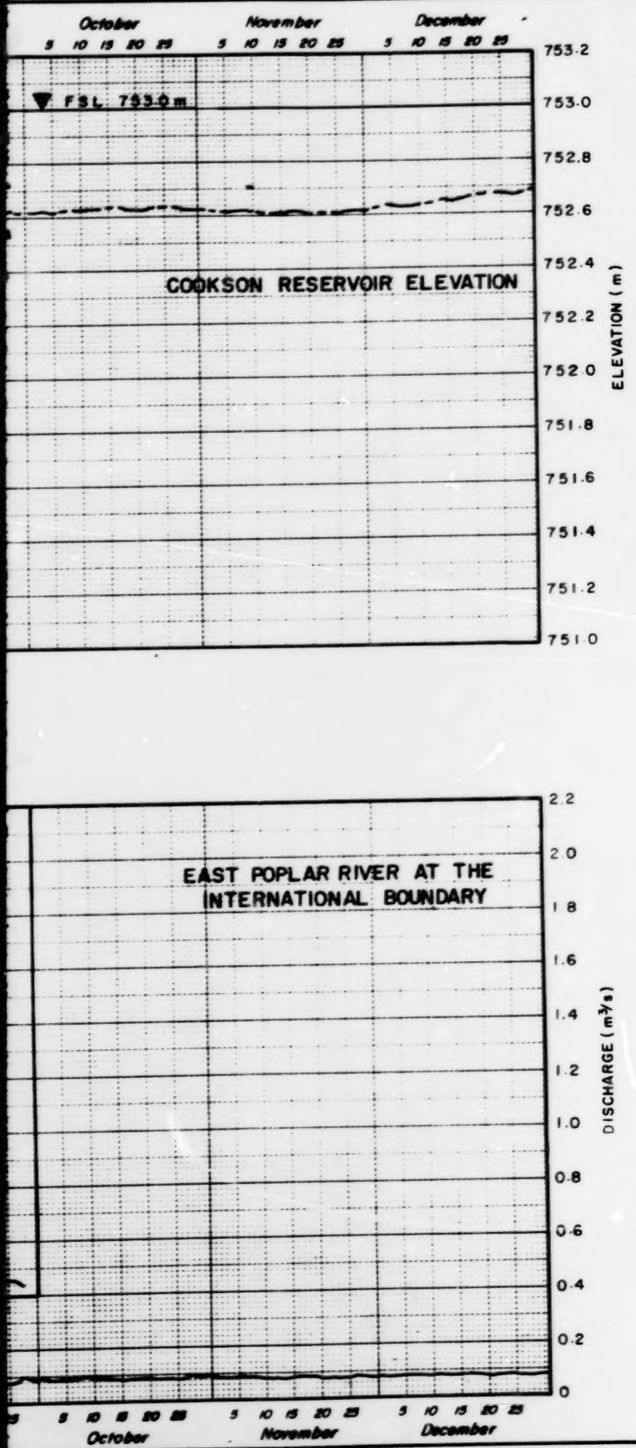

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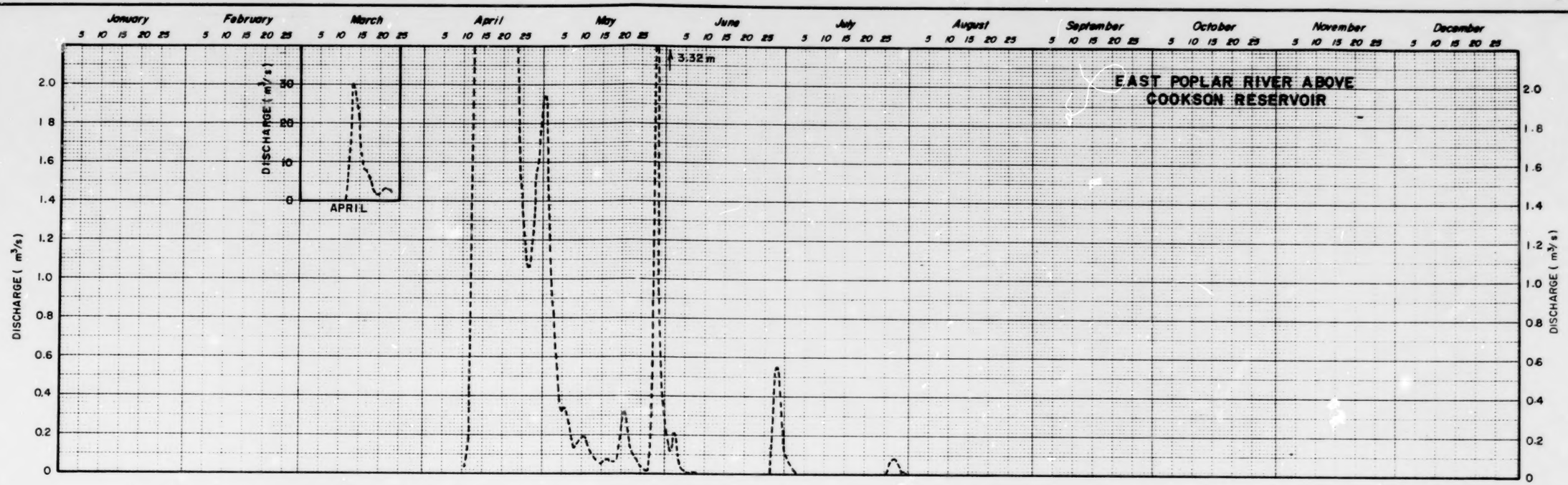
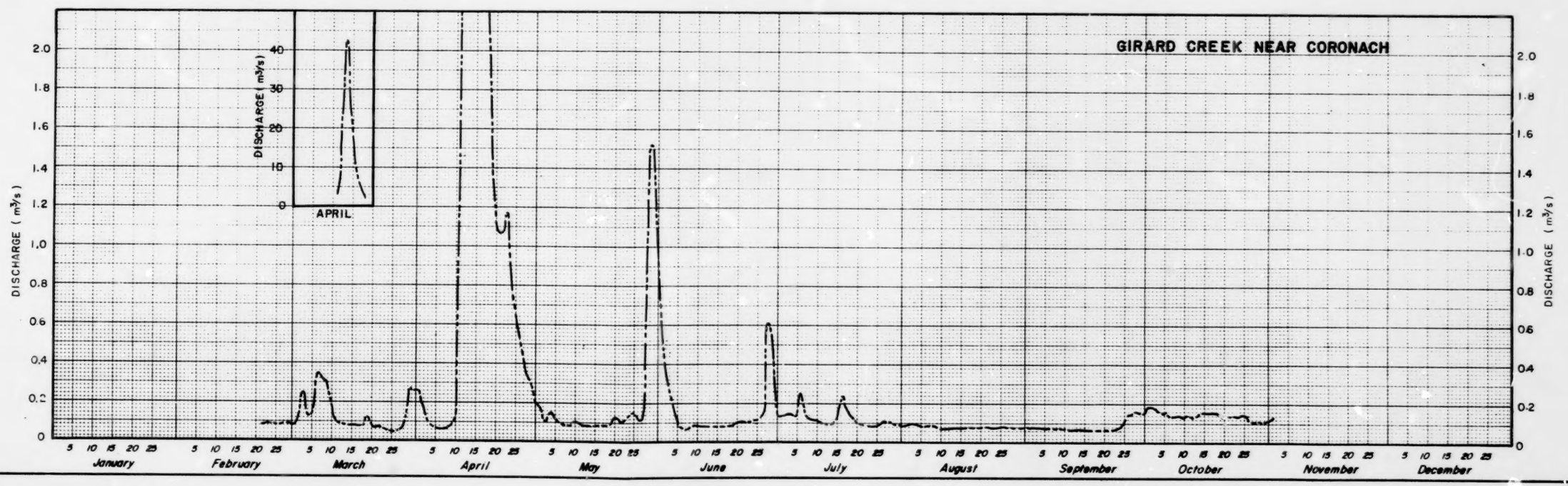
WATER MANAGEMENT ACTIVITIES
EAST POPLAR RIVER BASIN - 1982

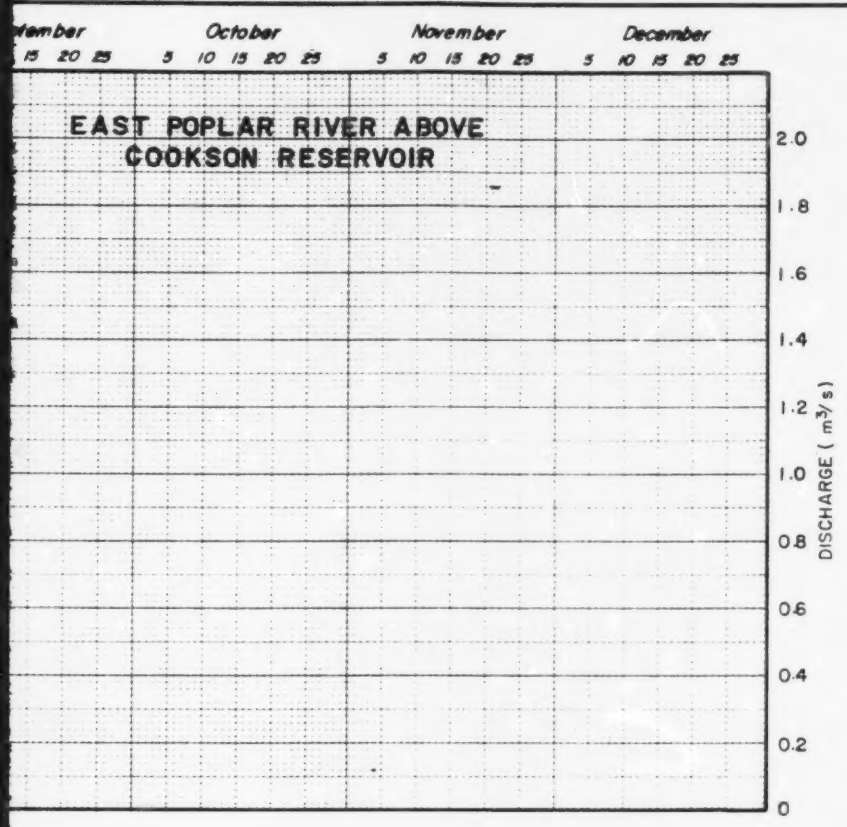
1982 COOKSON RESERVOIR ELEVATION
AND
1982 HYDROGRAPH FOR EAST POPLAR RIVER
AT THE INTERNATIONAL BOUNDARY

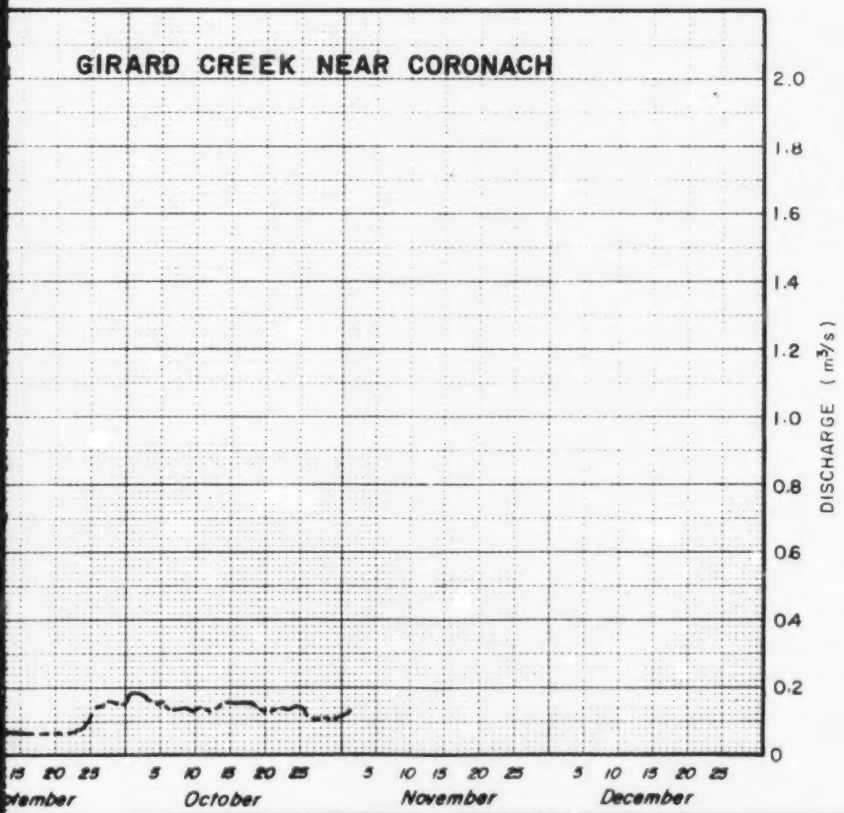
Drn. GVJ	Date NOV/83	Figure 2
Ck'd	Plan No H2-5(36)	


EAST POPLAR RIVER ABOVE COOKSON RESERVOIR
January
February
March
April
May
June
July
August
September
October
November
December
DISCHARGE (m³/s)
DISCHARGE (m³/s)
APRIL
3.32 m


GIRARD CREEK NEAR CORONACH
January
February
March
April
May
June
July
August
September
October
November
December
DISCHARGE (m³/s)
DISCHARGE (m³/s)
APRIL

Drn.
Ck'd





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WATER MANAGEMENT ACTIVITIES
EAST POPLAR RIVER BASIN - 1982

1982 HYDROGRAPHS FOR
EAST POPLAR RIVER ABOVE
COOKSON RESERVOIR AND
GIRARD CREEK NEAR CORONACH

Drn. G V J	Date NOV / 83	Figure 3
Ck'd	Plan No H2-5(37)	

APPENDIX A

INTERIM APPORTIONMENT IN THE

POPLAR RIVER BASIN

APPENDIX A

INTERIM APPORTIONMENT IN THE POPLAR RIVER BASIN

The following apportionment formula was recommended by the 1976 Poplar River Task Force[1]/ and has been tentatively adopted pending formal adoption of an apportionment formula:

The aggregate natural flow of all streams and tributaries in the Poplar River Basin crossing the International Boundary shall be divided equally between Canada and the United States subject to the following conditions:

1. The total natural flow of the West Fork Poplar River and all its tributaries crossing the International Boundary shall be divided equally between Canada and the United States but the flow at the International Boundary in each tributary shall not be depleted by more than 60 per cent of its natural flow.

2. The total natural flow of all remaining streams and tributaries in the Poplar River basin crossing the International Boundary shall be divided equally between Canada and the United States. Specific conditions of this division are as follows:

1/ The Poplar River Task Force was formed by the Souris-Red Rivers Engineering Board following a request by the International Joint Commission for a proposal for flow apportionment in the Poplar River basin.

a) Canada shall deliver to the United States a minimum of 60 per cent of the natural flow of the Middle Fork Poplar River at the International Boundary, as determined below the confluence of Goose Creek and Middle Fork.

b) the delivery of water from Canada to the United States on the East Poplar River shall be determined on or about the first day of June of each year as follows:

i) When the total natural flow of the Middle Fork Poplar River, as determined below the confluence of Goose Creek, during the immediately preceding March 1st to May 31st period does not exceed 4 690 cubic decametres (3,800 acre-feet), then a continuous minimum flow of 0.028 cubic metres per second (1.0 cubic feet per second) shall be delivered to the United States on the East Poplar River at the International Boundary throughout the succeeding 12 month period commencing June 1st. In addition a volume of 370 cubic decametres (300 acre-feet) shall be delivered to the United States upon demand at any time during the 12 month period commencing June 1st.

ii) When the total natural flow of the Middle Fork Poplar River, as determined below the confluence of

Goose Creek, during the immediately preceding March 1st to May 31st period is greater than 4 690 cubic decametres (3,800 acre-feet), but does not exceed 9 250 cubic decametres (7,500 acre-feet) then a continuous minimum flow of 0.057 cubic metres per second (2.0 cubic feet per second) shall be delivered to the United States on the East Poplar River at the International Boundary during the succeeding period June 1st through August 31st. A minimum delivery of 0.028 cubic metres per second (1.0 cubic feet per second) shall then be maintained from September 1st through to May 31st of the following year. In addition, a volume of 617 cubic decametres (500 acre-feet) shall be delivered to the United States upon demand at any time during the 12 month period commencing June 1st.

iii) When the total natural flow of the Middle Fork Poplar River, as determined below the confluence of Goose Creek, during the immediately preceding March 1st to May 31st period is greater than 9 250 cubic decametres (7,500 acre-feet), but does not exceed 14 800 cubic decametres (12,000 acre-feet), then a continuous minimum flow of 0.085 cubic metres per second (3.0 cubic feet per second) shall be delivered to the United States on the East Poplar

River at the International Boundary during the succeeding period June 1st through August 31st. A minimum delivery of 0.057 cubic metres per second (2.0 cubic feet per second) shall then be maintained from September 1st through to May 31st of the following year. In addition, a volume of 617 cubic decametres (500 acre-feet) shall be delivered to the United States upon demand at any time during the 12 month period commencing June 1st.

iv) When the total natural flow of the Middle Fork Poplar River, as determined below the confluence of Goose Creek, during the immediately preceding March 1st to May 31st period exceeds 14 800 cubic decametres (12,000 acre-feet) then a continuous minimum flow of 0.085 cubic metres per second (3.0 cubic feet per second) shall be delivered to the United States on the East Poplar River at the International boundary during the succeeding period June 1st through August 31st. A minimum delivery of 0.057 cubic metres per second (2.0 cubic feet per second) shall then be maintained from September 1st through to May 31st of the following year. In addition, a volume of 1 230 cubic decametres (1,000 acre-feet) shall be delivered to the United States upon demand at any time during the 12 month period commencing June 1st.

c) The natural flow at the International Boundary in each of the remaining individual tributaries shall not be depleted by more than 60 per cent of its natural flow.

3. The natural flow and division periods for apportionment purposes shall be determined, unless otherwise specified, for periods of time commensurate with the uses and requirements of both countries.